J. New York Entomol. Soc. 94(3):383–393, 1986

A NEW SPECIES OF THE *ANCHISIADES* GROUP OF *HERACLIDES* FROM VENEZUELA (LEPIDOPTERA: PAPILIONIDAE)

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Abstract.—*Heraclides matusiki,* new species, is described from a unique specimen collected in Sucre State, Venezuela, in 1912, based on an analysis of wing and genitalic characters of the *Heraclides anchisiades* species group.

With the aid of David Matusik (Field Museum of Natural History), we have been surveying incorporated and unincorporated Neotropical Papilionidae specimens at the American Museum of Natural History (AMNH) with particular emphasis on locating as yet undescribed taxa important as additions to this "well-known" butterfly group. Simultaneous with recent ecological changes influencing significant faunal extinctions in the Neotropical Realm (Brown, 1982, 1984) synoptic knowledge of terminal taxa is becoming increasingly important to current methods of systematics and biogeography. Important to this consideration is that undescribed taxa are still evident within poorly studied early collections deposited in major museums. Such depositions may represent the only extant specimens of such taxa (Rütimeyer, 1969; Johnson, Rozycki and Matusik, 1985, 1986). Initial contributions from the above-mentioned survey include recognition of the species status and previously unrecognized male of *Pterourus diaphora* (Staudinger) (Johnson, Rozycki and Matusik, 1985) and description of the little-known female of *Pterourus xanthopleura* (Godman & Salvin) (Johnson, Rozycki and Matusik, 1986). Interestingly, both of these are represented solely by specimens in European or United States museums from samples collected prior to 1920.

In 1984, among unincorporated New York Zoological Society material at the AMNH, we discovered a specimen (Fig. 1A, B) taken in 1912 at Caripito, Venezuela, which though clearly representative of the *anchisiades* Group of *Heraclides* (*sensu* Munroe, 1960; Hancock, 1983), differed notably in wing characters from any named taxon of that group. When genitalic dissection further confirmed the uniqueness of the specimen we contacted other lepidopterists studying Papilionidae as well as curators at major museums, asking their opinion of the specimen and that they search for additional examples. The breadth of response attested to the unusualness of the Caripito specimen and also emphasized the need for a taxonomic study of the *anchisiades* Group such as is presented below. Although all lepidopterists consulted agreed upon the uniqueness of the Caripito specimen, there were widely different opinions on its status and apparent affinities. Dr. Keith S. Brown (Universidade Estadual de Campinas, São Paulo, Brazil), who is preparing a synonymic list of

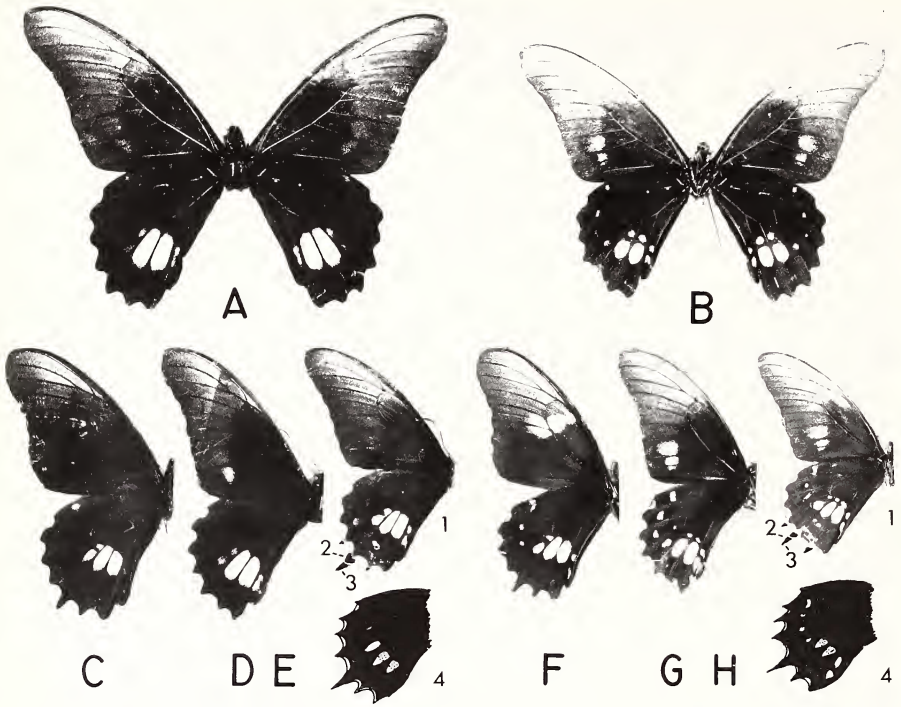

Fig. 1. Holotype *Heraclides matusiki,* A: upper surface. B: under surface. C. *H. rhodostictus pacificus* (Rothschild & Jordan), Colombia [AMNH] (upper surface) [F—under surface]. D. *H. anchisiades anchisiades,* Paramaribo, Surinam [AMNH] (upper surface) [G—under surface]. E. *H. isidorus brises,* (Rothschild & Jordan), Colombia [AMNH] (upper surface) [H—under surface]. Subscript numbers of E and H: 1—*H. i. brises*; 2—extent of terminad lengthening, vein CU_1 and adjacent veins cephalad and caudad in *H. i. isidorus*; 3—extent of same in *H. i. flavescens* (Oberthür); 4—Diagrammatic representation, maximum extent (white plus stiples) of white postmedian ellipses occurring in some Colombian and Ecuadorian *H. isidorus* and their minimum extent (stiples only) [E, upper surface; F, under surface].

Neotropical Papilionidae, viewed the specimen as a localized form of the geographically proximate congener *H. anchisiades* (Esper) (Fig. 1D). He saw the unique wing markings as either artifactual or as perhaps resulting from a localized mimicry phenomenon. He regarded the genitalic characters as simply extreme variation for the Group. Dr. Tommasso Racheli (Università Degli Studi di Roma, Rome, Italy), who is noted for his work on Neotropical *Parides* and *Battus,* saw the specimen's characters as more like those of *H. isidorus* (Doubleday) (Fig. 1E) or *H. rhodostictus* (Butler and Druce) (Fig. 1C). Dr. Lee D. Miller (Allyn Museum of Entomology, University of Florida, Sarasota, U.S.A.), who has published on various Papilionidae (particularly *Graphium*), viewed the specimen as displaying some characters traditionally used to denote all of the above species as well as the little-known *H. maroni* (Moreau), a

species currently known only from a few coastal sand forest French Guianian specimens. Consequently, Miller considered the Caripito specimen as possibly representing an undescribed species. The search of four major United States museums, six major South American museums, two major European museums and three private United States collections noted for their synoptic holdings of Papilionidae yielded no further specimens like the Caripito example.

TAXONOMIC ANALYSIS

The *Heraclides anchisiades* Group (*sensu* Munroe, 1961; Hancock, 1983) includes the taxa *hyppason* (Cramer), *pelaus* (Fabricius), *oxynius* (Hübner), *epenetus* (Westwood), *chiansiades* (Westwood), *pharnaces* (Doubleday), *erostratus* (Westwood), *rogeri* (Boisduval), *anchisiades, maroni, isidorus, rhodostictus* and *erostratinus* (Vasquez). As seen in Figure 2, current usage for these *Heraclides* (Beutelspacher and Howe, 1984; D'Abrera, 1981; D'Almeida, 1965; Jordan, 1907; Munroe, 1961; Rothschild and Jordan, 1906) attributes some species level taxa of this group distinctly insular distributions (*erostratinus, rogeri, maroni*) while others are regarded as complexes of "subspecies" with wide geographic ranges (*pelaus, rhodostictus, isidorus, anchisiades*).

Table 1 reviews the major wing and genitalic characters surveyed in our study of the *anchisiades* Group. As noted by Munroe (1961), wings of these species generally are characterized by: (a) tailless South American taxa mimetic of groups of *Parides* [Papilionidae] or (b) predominantly long-tailed Central and South American taxa either non-mimetic or mimetic of tailed Triodini [Papilionidae]. Analysis of male genitalic characters of the *anchisiades* Group (Figs. 3–5), along with those of selected females, indicates structural divergence within several of the so-called "subspecies" complexes approaching and/or exceeding that within some of the presently recognized species. It is possible, therefore, that overall species diversity in the group exceeds that based on the traditionally used characters of the wing (see Discussion). The genitalia of *H. hyppason* differ so drastically from other *anchisiades* Group members that we and Dr. Keith S. Brown (pers. comm.) have agreed that it should no longer be considered part of the Group. In addition, Hancock (1983) listed the taxon *dospassosi* Rütimeyer in the *anchisiades* Group. Known only from the holotype (AMNH), and not examined by Hancock, dissection of this specimen has shown it to represent the genus *Protesilaus* (Tribe Leptocircini *sensu* Hancock, 1983) (Johnson, Matusik and Rozycki, 1986). Omitting *hyppason* and *dospassosi,* clustering based on the characters of Table 1, along with consideration of female genitalia, suggests the following subgroups as most appropriate within the *anchisiades* Group: (1) *chiansiades, rhodostictus* complex; (2) *epenetus, pelaus, oxynius*; (3) *erostratinus, erostratus*; (4) *isidorus* complex, *maroni,* the new species *matusiki*; (5) *anchisiades* complex, *pharnaces, rogeri.*

Table 1 indicates that among the wing and genitalic characters diagnostic for species level taxa in the *anchisiades* Group, the Caripito specimen exhibits one wing and two genitalic characters unique to it. In addition, it shares one character with *H. isidorus* and *H. maroni,* one with *H. isidorus* and some taxa presently (perhaps incorrectly) placed as subspecies of *H. rhodostictus,* and one with eight other con-

Fig. 2. Geographic ranges of species and subspecies of the *Heraclides anchisiades* species Group (D'Abrera, 1981). Data from specimens in AMNH and collections of the junior author.

Table 1. Characters of *H. matusiki* ○; other *anchisiades* Group members ●; structure modified so as to make character distinction inapplicable ◑.

	CHIANSIADES	RHODOSTICTUS	EPENETUS	PELAUS	OXYNIUS	EROSTRATINUS	EROSTRATUS	ISIDORUS	MARONI	MATUSIKI	ANCHISIADES	PHARNACES	ROGERI
WING UPPER SURFACE													
Yellow Postmedian Bands, Both Wings; White Marginal Chevrons				●									
As Above, but Hindwing Only						●	●						
No Bands, Chevrons Only			●		●								
Red Postmedian Bands, Hindwing; Yellow Marginal Chevrons												●	
Large Red Elipses, Hindwing; Usually with White Postmedian Forewing Patch	●	●						●	●		●		●
Large, Cream-White Elipses, Hindwing; with Postmedian Forewing Patch										○			
MALE GENITALIA													
Valve, Terminal Tooth Centrad	●	●	◑	●	●	●	●	●	●		●	●	●
Valve, Terminal Tooth Ventrad			◑							○			
Valve, Terminal Serrations Dorsad Tooth Only					●	●	●	●	●	○			
Valve, Terminal Serrations, Dorsad and Ventrad Tooth											●	●	●
Valve, Terminal Serrations Lacking	●	●	●	●									
Aedeagus Very Curvate	●		●	●		●	●		●		●	●	●
Aedeagus Mildly Curvate		●			●			●					
Aedeagus Straight										○			
Socii Open								●	●		●		●
Socii Closed	●	●	●	●	●	●	●			○		●	

geners exclusive of *H. anchisiades, H. isidorus, H. maroni* and *H. rogeri.* Although the overall wing shape and pattern of the Caripito specimen is most suggestive of *H. anchisiades,* the former's unique wing character (large cream-white hindwing orbs) is approached only by specimens from a few populations of *H. isidorus* and *H. rhodostictus* in Columbia and Ecuador. Considering the above, and that the Caripito specimen comes from an area in which natural habitat may now be extirpated, we propose the following:

Heraclides matusiki, new species
Figs. 1A–B, 3H, 5A–D

Diagnosis. General maculation pattern like taxa of groups (1), (4) and (5) referenced above and in Figure 1; easily recognized by the two large cream-white orbs on the hindwing upper surface in vein interspaces distad vein M_3 (Fig. 1A, B), all other taxa in groups (1) and (5) having red to red-orange orbs (Fig. 1C, D, G, F), as do taxa of group (4) except for a few populations (Ecuador to Colombia) with white to yellow orbs about one-fourth the diameter of those on *matusiki* (Fig. 1E, H); hindwing under surface with a broken orange postdiscal arc of spots (obsolescent cephalad) and the spot of cell M_3 occurring distad in row with the large ellipses, other taxa with postdiscal spots red, with spot of cell M_3 located basad at the discal veins (*isidorus* complex and *rogeri*), or with all spots enlarged (*anchisiades* complex); antennae orange dorsad, not black as on all other taxa. In the male genitalia (1) *matusiki* (Figs. 3H, 5A) with terminal tooth of harpe nearly contiguous with harpe's ventral surface, (2) *matusiki, isidorus* (Fig. 3E, F), *maroni* (Fig. 4H), *erostratus* (Fig. 3B) and *oxynius* (Fig. 3A) with terminal serrations limited to dorsad of harpe's terminal tooth (other taxa as reviewed in Table 1, Figs. 3, 4 and 5B, C); (3) *matusiki* (Figs. 3H, 5D) with aedeagus straight, similar only to the mildly curvate aedeagii of some taxa of *isidorus* complex (Figs. 3E, F, 5E) and *rhodostictus* complex (Fig. 3J, K).

Description. MALE. Upper surface of the wings: forewing dark brownish black basad the postmedian area, noticeably lighter distad; powdered white ovate patch distad of postmedian area in cell CU_2. Hindwing uniformly as dark as basad area of forewing; two large postmedian cream-white ellipses in discal through postmedian area of cells CU_1 and CU_2 with adjacent areas of cells 2^A and M_3 having oblong parallel cream-white patches. Crennated margin without white chevrons except in cells RS and M_1. No taillike extension of vein terminus CU_1. Under surface of the wings: forewing as on upper surface but with powdered white ovate patches in both cells CU_2 and CU_1. Hindwing with large postmedian ellipses of cells CU_1 and CU_2 bright white, edged orange distad and with complementary smaller bright orange spots occurring as two in cell 2^A (postmedian and discal), one in cells CU_1 and CU_2 (postdiscal), and variously obsolescent cephalad to the costal margin (postmedian). An orange line is apparent in cell 2^A at the margin and on all vein termini thence to vein CU_1. Length of forewing: 53.0 mm (holotype). *Male Genitalia.* Figures 3H, 5D. Overall configuration as in other members of species group but differing markedly as follows: aedeagus straight, not curved; terminal tooth of valval harpe nearly contiguous with ventral surface of harpe; socii closed (see Diagnosis and Remarks).

FEMALE. Unknown.

Holotype. ♂ (Fig. 1A, B). Venezuela, Caripito, 7 January 1912, ex. collection New

York Zoological Society Tropical Research Department, William Beebe, Director; deposited AMNH.

Distribution. Known only from the type locality, adjacent to the isolated montane region characterizing the Sucre State in eastern Venezuela. The area of Caripito is vastly more populated today than in 1912. It is therefore possible that if the original distribution area of *H. matusiki* was highly insular, the species may be extinct.

Etymology. The species is named for David Matusik who first noticed it in AMNH holdings and in recognition for his discoveries of several new and unusual Papilionidae, including *Graphium meeki inexpectatum* L. & J. Miller, the type gender of *P. diaphora,* the species status of *Papilio huanucana* (de Luque) and the life history of *Papilio machaonides* Esper.

DISCUSSION

Taxonomic Characters of the anchisiades *Group*

Valvae. Hitherto, most students of Papilionidae (Munroe, 1960; Hancock, 1983; Beutelspacher and Howe, 1984) have utilized characters of the valval harpe in the diagnosis of species level taxa. In the *anchisiades* Group each of the species evidences a distinct caudal configuration of the harpe. There is a variously located terminal tooth, with or without serrations located dorsad and/or ventrad. As noted in Figures 3–5, there is apparent overlap in the species-distinctive configurations (summarized in Table 1) within and between several of the "subspecies" now associated with the *H. isidorus* and *H. rhodostictus* complexes. This suggests either misassociation of some of these trinomens or the possibility that several sympatric species occur in these complexes in Colombia and Ecuador. *Aedeagii*: Several species within the *anchisiades* Group possess distinct aedeagii, though the generalized configuration of the group is a mildly curvate structure. *H. matusiki* appears distinct in having a straight aedeagus (Figs. 3H, 5D), while *H. maroni* evidences a similarly unique radically curvate structure. Since both species appear to be highly insular, these characters strongly suggest specificity. *Socii:* Some consistent differences are notable among the various species clusters with the *anchisiades* Group. However, the taxonomic utility of these differences (Figs. 3–5, Table 1) is uncertain. Characters of the socii have not been widely used by papilionid workers. Notwithstanding, our study of the *scamander* Group of *Pterourus* (Tribe Papilionini *sensu* Hancock, 1983; Johnson, Matusik and Rozycki, 1985) showed significant socii differences among the species of this group. In the *anchisiades* Group socii have two overall configuration—(a) an apparent "open" lateral configuration [idealized by vertical hatching in Figs. 3–4] in which the outer lateral wall of the socii are variously transparent with sclerotized portions of the inner lateral wall showing markedly through and (b) an apparent "closed" lateral configuration in which the outer lateral wall is sclerotized thickly and obscures any view of the inner lateral wall.

Species Status of H. matusiki

We apply the species category to *matusiki* because of the variety of characters which distinguish its holotype from all presently known congeners (see Diagnosis and Table I). If the majority of characters in *H. matusiki* approximated those of a particular described taxon, we might have suggested *matusiki* as a subspecies thereof.

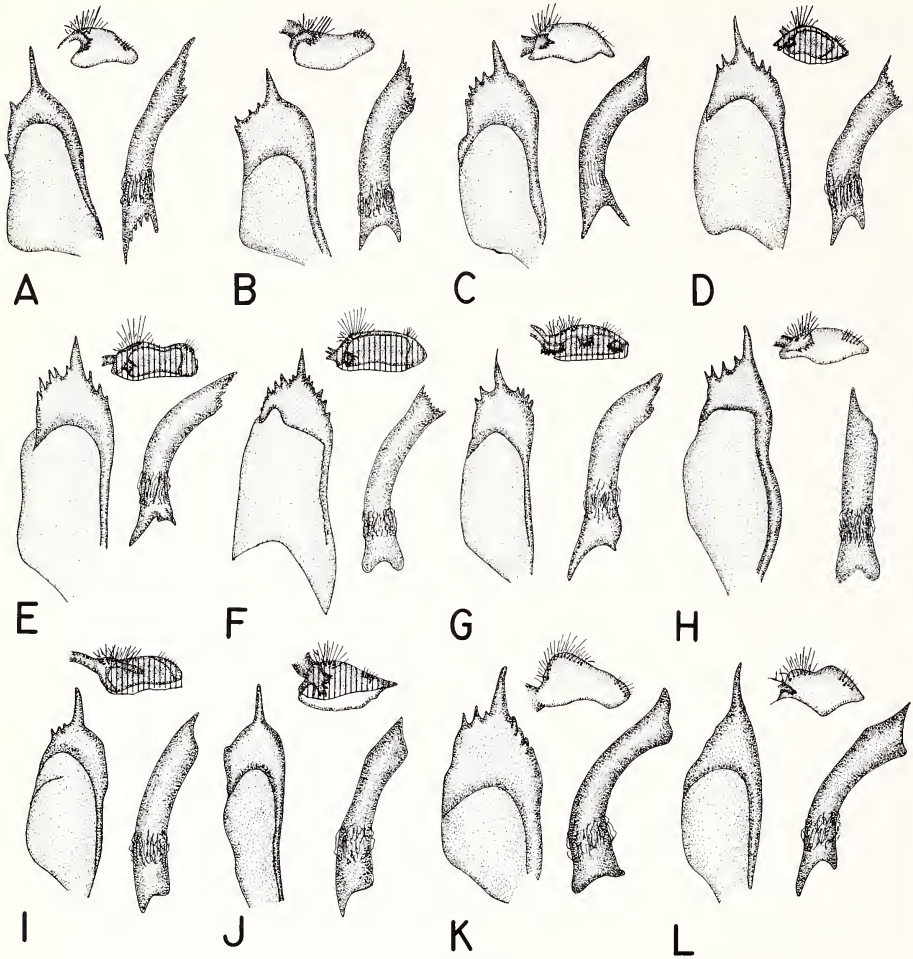

Fig. 3. Male genitalia of *Heraclides anchisiades* species Group. Format—above each letter, left, harpe of valve, inner lateral view; right, aedeagus, lateral view; center, above, socii, outer lateral view. Dissections all AMNH, locality of figured specimen listed first with number dissected in parentheses following, additional localities and number in brackets thereafter. A—*oxynius,* Cuba (3); B—*erostratus,* Guatemala (3) [Verapaz, Guatemala (1)]; C—*erostratinus,* Jalapa, Mexico (3) [Veracruz, Mexico (1)]; D—*anchisiades anchisiades,* Paramaribo, Surinam (3) [Port-of-Spain, Trinidad (1); Jantun-yacu, Ecuador (1); Bogotá, Colombia (1); Iquitos, Peru (1)]; E—*anchisiades idaeus* (Fabricius), Oaxaca, Mexico (3) [Guatemala (1); Honduras (1); Barro Colorado, Panama (1); San Jeronimo, Chiapas, Mexico (1)]; F—*anchisiades capys* (Hübner), Santa Catarina, Brazil (3) [Misiones, Argentina (1); Santisima-Trinidad, Paraguay (1); Bolivia (1); Caviuna, Brazil (1)]; G—*rogeri,* Pisté, Mexico (3); H—*matusiki,* Caripito, Venezuela (1); I—*isidorus isidorus,* Lima, Peru (3) [Rio Seco, Peru (1); Tingo Maria, Peru (1); Rio Huallaga, Peru (1)]; J—*isidorus brises* Colombia (3) [Cauca Valley, Colombia (1); Yellow-orbed *isidorus* (unnamed population), Colombia (2)]; K—*pharnaces,* Morelos, Mexico (3) [Chiapas, Mexico (1)]; L—*epenetus,* Balzapamba, Ecuador (3).

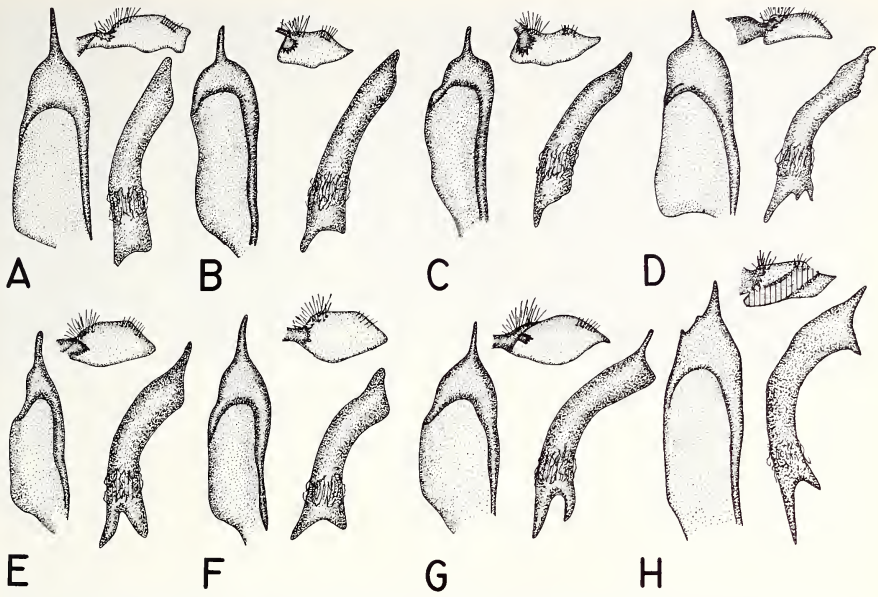

Fig. 4. Male genitalia of *Heraclides anchisiades* species Group (cont.). Format as in Fig. 3. A—*chiansiades,* Janjui, Peru (3) [Rio Ortequaza, Colombia (1); Jantun-yacu, Ecuador (1)]; B—"*rhodostictus*" *flavescens* (ssp. usually associated with *isidorus*) Huagra-yacu, Ecuador (3) [Abitagua, Ecuador (1); yellow-orbed *rhodostictus* (unnamed population), Ecuador (1)]; C—*rhodostictus pacificus,* Colombia (3) [Guamoco, Colombia (1)]; D—*rhodostictus rhodostictus,* Rio Grande, Honduras (3); E—*pelaus pelaus,* Jamaica (3); F—*pelaus imerius* (Godart), Adjuntas, Puerto Rico (3); G—*pelaus atkinsi* (Bates), Havana, Cuba (2); H—*maroni,* French Guiana (1) [AME].

To do this, however, when characters of *H. matusiki* are either unique or variously shared with several other species of the group, would imply that characters used to define species within the group (especially genitalic characters) have no utility. The latter is not the case according to the data reviewed herein.

The variety of specialists' opinions concerning status and affinities of *matusiki* results less from the uniqueness of the holotype than from methodological differences. How to apply the International Code of Zoological Nomenclature (ICZN) obligatory categories in neotropical taxa is currently a subject of debate in lepidopterology. Generally, South American lepidopterists construe any evidence of possible wild-caught hybrids as indicative of subspecies status in the inferred parent taxa (Keith S. Brown, Jr., pers. comm.). Further, the hypothesis of Pleistocene "refugia" is generally accepted as the major historical factor underlying contemporaneous taxonomic and distributional relations (see, for instance, Pranz et al., 1982). As a result South American lepidopterists generally choose to view poorly known or little studied populations (or specimens) as representing subspecies of the most geographically proximate congener. Such a method is in the best sense utilitarian, considering that most Neotropical butterfly groups have received little morphological study. Further, such studies do not always offer reliable taxonomic characters. Preparation of a

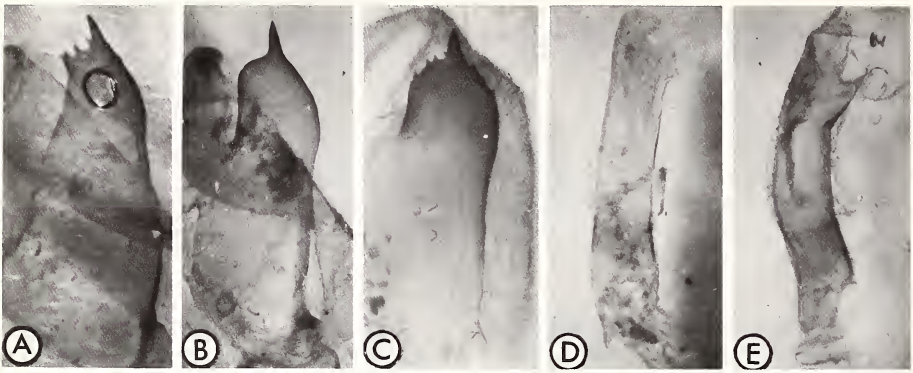

Fig. 5. *Heraclides anchisiades* species Group, particular features: A: valval harpe (with rest of valve folded back) *H. matusiki,* inner lateral view; B: same, *H. isidorus,* Ecuador, specimen with small white postmedian spots [see Fig. 1, E4 and H4, and Diagnosis] as with taxon *flavescens* perhaps best associated with *rhodostictus*; C: same, *H. anchisiades anchisiades,* Parimaribo, Surinam, regionally sympatric with *H. matusiki*; D: aedeagus, lateral view, *H. matusiki*; E: aedeagus, lateral view, *P. isidorus brises,* Colombia.

synonymic list of Neotropical Papilionidae by South American lepidopterists is currently in progress and will have involved a significant amount of morphological investigation (Keith S. Brown, Jr., pers. comm.). However, the view of apparent wild-caught hybrids and historical processes will affect the opinions on synonymy. Other methods (e.g., cladistics, or vicariance biogeography) would not construe possible wild-caught hybrids as indicative of subspecies categories. Further, with sufficient morphological evidence, this view might also reject lumping with the most geographically proximate congener and, instead, propose a species level taxon with an apparent vicariant sister taxon. Concerning *H. matusiki* and *H. maroni,* and data summarized in Table 1 and *Diagnosis,* it is reasonable to consider these two taxa as eastwardly distributed sister species of the *H. isidorus* complex. However, given current views from which most common taxonomic usages for Neotropical taxa are derived, we suspect that most South American lepidopterists will come to view both *H. matusiki* and *H. maroni* as subspecies of *H. anchisiades.*

ACKNOWLEDGMENTS

Numerous specialists and museum curators aided in discussing data, reviewing manuscripts of searching collections. Below, we list these persons, noting after each the collection surveyed: Dr. Keith S. Brown (Collection Universidade Estadual de Campinas, São Paulo, Brazil; Museu Nacional, Rio de Janeiro, Brazil; Collection Ernesto W. Schmidt-Mumm, Bogotá, Colombia; Collection Museo de Historia Natural "Javier Prado," Lima, Peru); Dr. Tommaso Racheli (Collection Instituto de Zoologia Argricola, Maracay, Venezuela; Collection Tommaso Racheli); Dr. Ernesto W. Schmidt-Mumm (Collection Ernesto W. Schmidt-Mumm); Dr. Olaf H. H. Mielke (Collection, Dep. de Zoologia, Universidade Federal do Paraná, Curitiba, Brazil); Dr. Lee D. Miller (Allyn Museum of Entomology of the University of Florida, Sarasota, Florida, U.S.A.); Dr. H. T. Hannemann (Zoologisches Museum der Humbolt Universität, Berlin, Germany); Dr. Rienk de Jong (Rijkmuseum van Natuurlijke Historie, Leiden, Netherlands); Dr.

John H. Rawlins (Carnegie Museum of Natural History, Pittsburgh, Pennsylvania, U.S.A.), Dr. Robert K. Robbins (National Museum of Natural History, Washington, D.C., U.S.A.). Philip Ackery [British Museum (Natural History), London, United Kingdom] responded that the specimen seemed unfamiliar but staff lacked time to make a detailed search. In addition we used the collections of David Matusik (Skokie, Illinois), that of the junior author and one anonymous commercial dealer who retains significant holdings in unusual Papilionidae.

In regard to our treatment of the *anchisiades* Group, Dr. Keith Brown kindly reviewed drafts of the manuscript as well as suggested and/or contacted for us numerous of the above listed workers or collections. We are most grateful for his generous assistance in this regard and any apparent disagreements over the content of this paper are purely scientific. Dr. Lee D. Miller discussed this project with us on several occasions and Dr. Ernesto W. Schmidt-Mumm and Dr. Tommasso Racheli also kindly considered draft manuscripts or materials of this study. Two anonymous reviewers made very helpful comments concerning the paper and Dr. Randall T. Schuh (AMNH) made numerous helpful suggestions concerning methods and procedures. Dr. Frederick H. Rindge (AMNH) kindly has facilitated access to AMNH papilionid holdings for Mr. Matusik and the junior author.

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Received July 19, 1984; accepted December 23, 1985.